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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Attorney Docket No.: 26202.140

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Title: CUTTING UNIT

Cross-Reference To Related Applications And Claim To Priority

This application claims the benefit under 35 U.S.C. § 119 of utility model application number 203 07 241.3, filed May 8, 2003 and utility model application number 203 19 003.3, filed December 5, 2003, both in the Federal Republic of Germany, and the disclosures of which are incorporated herein by reference.

Field Of The Invention

The invention concerns a cutting unit for trimming sheet material such as paper, films or the like, having a planar bed for supporting the sheet material, which bed is equipped on one side with a guillotine cutting device that has a pivotably mounted knife arm having a blade held thereon and a counterknife held in stationary fashion on the bed.

Background Of The Invention

Cutting units of the aforesaid kind are provided in particular for office use. They serve to trim paper sheet material, usually of DIN A4 format and smaller, at most DIN A3 format. The cutting units have a guillotine cutting device on one longitudinal side. A guillotine cutting device of this kind has a knife arm, mounted pivotably about a horizontal axis at one corner of the bed, on which a cutting knife, projecting on the lower side, is attached. It corresponds to a counterknife secured on the bed. Arranged at the free end of the knife arm is a handle with which the knife arm can be pivoted down from an upwardly pivoted position, with the consequence that a sheet material projecting beyond the counterknife is trimmed. Such cutting units have been used in offices for decades in essentially the same configuration.

Sheet material can be cut relatively well with such cutting units if the sheet material projects not inconsiderably beyond the counterknife, since otherwise the risk exists that the excess length will be pushed downward by the blade and not trimmed cleanly. A sheet stack comprising several sheets can also be cut simultaneously, provided the sheet stack's height is not too great.

5 Difficulties are encountered in producing a smooth cut edge if, in particular, there is only
a small excess length beyond the counterknife. With guillotine cutting devices the risk
also exists that the bearing assembly of the knife arm may acquire play over time, so
that in order to produce a smooth cut it is necessary to press the knife arm with
considerable pressure against the counterknife. Since this condition of the cutting unit is
10 not detectable, unsatisfactory cutting results are obtained.

Summary Of The Invention

It is the object of the invention to configure a cutting unit of the kind cited initially in such
15 a way that good cutting results are obtained even under difficult conditions.

According to the present invention, this object is achieved in that there is provided,
preferably on a different side of the bed, a rotary cutting device that has a knife carriage
displaceable on a guide bar and a circular knife rotatably mounted therein. The basic
20 idea of the invention is thus to make available a cutting unit having two different kinds of
cutting devices, the one cutting device having strengths in the area in which the other
cutting device works less well. Whereas the guillotine cutting device is suitable in
particular for trimming sheet stacks, the rotary cutting device according to the present
invention is characterized by a clean cut even with minimal excess lengths or when
25 cutting off margins. It can therefore be used particularly effectively for trimming the
margins of photographic prints or the like. The cutting unit according to the present
invention is thus substantially more versatile to use, and takes up no more space than
known cutting units of the species.

30 In a development of the invention, provision is made for the guillotine and rotary cutting
devices to be arranged so that they have cutting directions extending in parallel fashion.
This creates the possibility of trimming sheet material on both sides simultaneously and
in absolutely parallel fashion, in which context the spacing could be dimensioned in
accordance with a specific standard format. There can also be provided, between the
35 guillotine and rotary cutting devices, a stop bar that extends parallel to the cutting
directions and is displaceably guided transversely to the cutting directions.

5 The circular knife advantageously has a rotation axis parallel to the bed. The circular knife should be in contact, or at least be pressable, with its blade against a counterknife bar that can be made, for example, of plastic.

10 According to a further feature of the invention, provision is made for the guide bar to be raisable from a lower cutting position into an upper initial position, and lowerable from the latter back into the cutting position; and for the gap between bed and guide bar to be inaccessible from the ends of the guide bar. The idea underlying this is to effect the vertical movement of the circular knife not by way of the knife carriage but by means of the guide bar, by first raising the guide bar in order to slide the sheet stock through and
15 then lowering it into the cutting position in which the circular knife rests on the bed. This makes handling of the cutting operation substantially simpler, and results in clean cuts. It is particularly important in this context that the gap between guide bar and bed be inaccessible from the ends of the guide bar, i.e. be covered there, so that it is not possible for the operator's fingers to enter the gap in that region and get caught as the
20 guide bar is lowered.

In a further embodiment of the invention, it is proposed that the guide bar be guided in vertically displaceable fashion in the region of its ends so that it can be raised and lowered parallel to the bed, preferably by no more than 20 mm, preferably approx. 12
25 mm. As an alternative to this, however, provision can also be made for the guide bar to be mounted pivotably about a horizontal axis in the region of one end, specifically through an angle of at most 10°, preferably 4 to 5°. In order for the gap between bed and guide bar to be inaccessible at the two ends of the guide bar, those ends should overlap the bed. It is understood that in the context of a pivotably mounted guide bar,
30 this overlap is necessary only at the latter's free end and not in the region of the pivot bearing, since the pivot bearing itself already constitutes a barrier to access to the gap between bed and guide bar. If an overlap is provided, this can be done by way of a downwardly projecting protective tab overlapping the bed. To ensure good lateral guidance of the guide bar in this region, the protective tab should fit into a matching slot
35 in the bed.

The guide bar can be suspended in such a way that without actuation, it assumes the cutting position in which the circular knife rests on the bed. The guide bar can be raised

5 manually in order to slide the sheet material through the gap between guide bar and bed. As an alternative to this, however, the possibility also exists that without actuation, the guide bar is held in the initial position by means of a spring. This facilitates sliding of the sheet material through the gap, but requires that the guide bar be pushed down for the cutting operation. A clean cut is obtained with this embodiment as well, however,
10 since the guide bar can be pushed down with one hand and the knife carriage displaced with the other hand; this is much simpler in terms of handling than with known rotary cutting devices, in which the knife carriage must be pushed down and simultaneously displaced.

15 Provision is further made according to the invention for the guide bar to be retainable in the cutting position at its vertically movable end(s) with an immobilization device or devices. The guide bar is thereby immobilized for the cutting operation and cannot move by itself, and need not be pushed down during the cutting operation if a spring is working against it. This simplifies operation of the cutting unit.

20 The or each immobilization device is preferably embodied as a snap device into which the guide bar automatically and disengageably snaps upon movement into the cutting position, so that immobilization of the guide bar in the cutting position is not associated with additional actions. All that is necessary for the disengagement operation after the
25 cutting operation is an actuation of the snap device in order to disengage it. The snap device can have for that purpose an actuation slider that is mounted at an appropriate location.

In a further embodiment of the invention, it is proposed that the bed have a region
30 having a flexible edge, preferably a cutting bed made of an elastomeric material, and that the guide bar with the knife carriage be associated movably with the cutting unit. The user thus has the ability to arrange and use the rotary cutting device differently within the region of the elastic cutting bed. The guide bar should, in this context, protrude above a support plate that is placeable on the cutting bed. The support plate is
35 preferably made of a transparent plastic, and lines can be provided that extend parallel to the guide bar and permit alignment of the guide bar.

5 Description Of The Figures

The invention is illustrated in more detail, with reference to exemplary embodiments, in the drawings, in which:

- 10 FIG. 1 is an oblique view of the cutting unit according to the present invention;
- FIG. 2 is a side view of the rotary cutting device of the cutting unit according to FIG. 1;
- 15 FIG. 3 is a cross section through the cutting unit according to FIGS. 1 and 2 in the region of the rotary cutting device;
- FIG. 4 is an oblique view of a further exemplary embodiment of the cutting unit according to the present invention, before the cutting operation;
- 20 FIG. 5 is the oblique view according to FIG. 4, after the cutting operation;
- FIG. 6 is an oblique view of a third embodiment of a cutting unit, restricted to the corner region having the free end of the guide bar;
- 25 FIG. 7 is an oblique view of a fourth exemplary embodiment of the cutting unit according to the present invention, with the rotary cutting device placed movably with respect to it; and
- 30 FIG. 8 is the oblique view according to FIG. 6 with the rotary cutting device placed on the cutting unit.

Detailed Description Of The Preferred Embodiment(s)

- 35 Cutting unit 1 depicted in FIG. 1 comprises a frame plate 2, substantially rectangular in plan, whose horizontal upper side forms a bed 3 for sheet material to be trimmed. A guillotine cutting device 4 is arranged on the upper (in this view) longitudinal side, and a rotary cutting device 5 on the lower (in this view) longitudinal side.

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Guillotine cutting device 4 comprises a knife arm 6 that is mounted pivotably, in a bearing 7, about a horizontal axis extending transversely to the longitudinal side there. Knife arm 6 is equipped on its lower side, substantially over its entire length, with a cutting knife that is concealed in this view. Configured at the free end of knife arm 6 is a handle 8 with which knife arm 6 can be pivoted upward and downward. In the position shown, knife arm 6 is located in the lower terminal position.

The cutting knife of knife arm 6 corresponds to a counterknife 9 that is recessed flush into bed 3. Joined to knife arm 6 is a protective apparatus 10 that covers the cutting knife when knife arm 6 is raised, and thus offers protection for the operator.

Rotary cutting device 5 comprises a guide bar 11 that extends at a distance from bed 3 between two holding blocks 12, 13, parallel to the cutting edge and cutting direction of guillotine cutting device 4. A knife carriage 14 is guided on guide bar 11 displaceably in the direction of the longitudinal axis of guide bar 11, and can be slid manually back and forth.

As shown in particular by FIGS. 2 and 3, a circular knife 15 is mounted rotatably on knife carriage 14, specifically about a horizontal axis 16 that extends transversely to the longitudinal axis of guide bar 11. Circular knife 15 projects downward beyond knife carriage 14 and makes contact against a counterknife bar 17 that is recessed into bed 3 and extends parallel to guide bar 11. In the example according to FIGS. 2 and 3, circular knife 15 is presently traveling over a sheet of paper 18 and cutting off its excess length 19 by displacement of knife carriage 14.

Extending between guillotine cutting device 4 and rotary cutting device 5, parallel to them, is a stop bar 20 against which sheet material can be aligned. Stop bar 20 encompasses at the end a guide bar 21, and is guided thereon in transversely displaceable fashion. Guide bar 21 extends at right angles to the cutting directions of guillotine cutting device 4 and rotary cutting device 5.

Cutting unit 31 depicted in FIGS. 4 and 5 comprises a frame plate 32, substantially rectangular in plan, whose horizontal upper side forms a bed 33 for sheet material to be

5 trimmed. Located in the region of the front (in this view) longitudinal side of frame plate 32 is a rotary cutting device 34. The guillotine cutting device additionally present in the embodiment according to FIGS. 1 through 3 is not depicted here in further detail.

10 Rotary cutting device 34 comprises a guide bar 35 that extends, at a distance from bed 33, parallel to the longitudinal side of frame plate 32. A knife carriage 36 is guided, displaceably in the direction of the longitudinal axis of guide bar 35, on guide bar 35. It surrounds guide bar 35 in U-shaped fashion and has on the upper side an attachment 37 with which knife carriage 36 can be slid manually back and forth. Knife carriage 36 has, on the front (in this view) side, a bearing shaft 38 which extends horizontally and
15 transversely with respect to the longitudinal axis of guide bar 35, and on which a circular knife 39 is mounted in freely rotatable fashion. Attached on bed 33 below circular knife 39 is a support surface 40 that is made of an elastomeric material. It extends over the entire movement range of circular knife 39.

20 Guide bar 35 is joined pivotably, at the end located remotely in the views, to frame plate 32 via a pivot bearing 41. The pivot axis extends horizontally and transversely to the longitudinal axis of guide bar 35. Access to the gap between guide bar 35 and bed 33 is blocked by pivot bearing 41 in the region of this end of guide bar 35. At the other end, guide bar 35 comprises a downwardly directed protective tab 42. The latter fits into a
25 guide groove 43 that is shaped into the short longitudinal side of frame plate 32 in such a way that protective tab 42 is enclosed on both sides and laterally guided.

In FIG. 4, guide bar 35 is located in an upwardly pivoted initial position, so that circular knife 39 is raised away from support surface 40 and a sheet material 44 to be trimmed
30 can be slid without impediment through the gap between guide bar 35 and bed 33. In this position, guide bar 35 is held by a spring arranged close to pivot bearing 41, knife carriage 36 being located adjacent to pivot bearing 41. In this position, the lower end of protective tab 42 is still located in guide groove 43 so that the gap between guide bar 35 and bed 33 is inaccessible from this end as well.

35 For the cutting operation, guide bar 35 is pivoted downward against the spring and then assumes the position depicted in FIG. 5, in which it extends substantially parallel to bed 33. In that context, circular knife 39 comes into contact against support surface 40.

5 Knife carriage 36 is then displaced out of the position shown in FIG. 4 in the direction of the free end of guide bar 35 with slight pressure on support surface 40, in which context circular knife 39 performs a rotary movement and simultaneously cuts sheet material 44. Trimmed sheet material portion 45 resting on bed 33, and cut-off sheet material portion 46, remain behind.

10 Cutting unit 47 depicted in FIG. 6 differs from cutting unit 31 only in the configuration of the region at the free end of guide bar 35; for identical or functionally identical parts, therefore, the reference numbers already used for FIGS. 4 and 5 are adopted for the description of this embodiment of cutting unit 47, and reference is made to the previous
15 description. Only the differences will be presented below.

Instead of protective tab 42, guide bar 35 has at its free end a superimposed terminating block 48 that is enclosed on both sides by a guide block 49 embodied as a horizontal U and is thereby guided transversely to its longitudinal axis. Shaped into the
20 end surface of terminating block 48 is a recess (not depicted in detail here) into which fits a catch guided in guide block 49. The catch is joined rigidly to an actuation slider 50 that is guided displaceably in the directions of double arrow A, actuation slider 50 being tensioned by a spring in the direction toward terminating block 48.

25 In the depiction shown, guide bar 35 is located in the (lower) cutting position and is held in that position by the catch, so that the cutting operation can be performed with no need to push guide bar 35 down. After the cutting operation, actuation slider 50 is displaced to the left, i.e. away from terminating block 48, so that the catch moves out of the recess in the end surface of terminating block 48 and guide bar 35 is released. The
30 latter then pivots automatically, because of the action of the spring, into the upper initial position. For another cutting operation, guide bar 35 is once again pivoted toward bed 33. When the cutting position is reached, the catch snaps into the recess in terminating block 48 and thus once again retains guide bar 35.

35 Cutting unit 51 depicted in FIGS. 7 and 8 likewise comprises a frame plate 52, substantially rectangular in cross section, whose horizontal upper side forms a bed 53 for sheet material to be trimmed. A guillotine cutting device 54 is provided on an upper

- 5 (in this view) longitudinal side, and a rotary cutting device 55 in the region of the lower (in this view) longitudinal side.

Guillotine cutting device 54 comprises a knife arm 56 that is mounted pivotably, in a bearing 57, about a horizontal axis extending transversely to the longitudinal side there.

- 10 Knife arm 56 is equipped on its lower side, substantially over its entire length, with a cutting knife that is concealed in this view. Configured at the free end of knife arm 56 is a handle 58 with which knife arm 56 can be pivoted upward and downward. In the position shown, knife arm 56 is located in the lower terminal position.
- 15 The cutting knife of knife arm 56 corresponds to a counterknife, also not visible here, that is recessed flush into bed 53. Joined to knife arm 56 is a protective apparatus 59 that covers the cutting knife when the knife arm is raised, and thus offers protection for the operator.
- 20 Rotary cutting device 55 comprises a guide bar 60 on which a knife carriage 61 is guided displaceably in the direction of the longitudinal axis of guide bar 60. It can be slid manually back and forth. A circular knife (not depicted here in detail) is mounted rotatably on knife carriage 61, specifically about a horizontal axis that extends transversely to the longitudinal axis of guide bar 60. The circular knife projects
- 25 downward beyond knife carriage 61. Guide bar 60 is attached on a support plate 62. Support plate 62, and guide bar 60 with knife carriage 61, are movable parts that can be placed at the very bottom onto bed 53 with support plate 62, as is apparent from FIG. 2.
- 30 Also belonging to rotary cutting device 55 is a cutting bed 63 that, for use, can be inserted into a recess 64 in bed 53, as is likewise apparent from FIG. 2. Cutting bed 63, made of an elastomer, terminates flush with the upper surface of bed 53. Cutting bed 63 acts as a counterknife for the circular knife.
- 35 In order for rotary cutting device 55 to be used, the unit comprising guide bar 60, knife carriage 61, support plate 62, and cutting bed 63 is placed in the position shown in FIG. 8. The unit comprising guide bar 60, knife carriage 61, and support plate 62 on cutting

- 5 bed 63 can be displaced by hand to allow the cut to be performed at the intended point on the sheet material.

Extending between guillotine cutting device 54 and rotary cutting device 55, parallel to them, is a stop bar 65 against which sheet material can be aligned. Stop bar 65
10 encompasses at the end a guide bar 66, and is guided thereon in transversely displaceable fashion. Guide bar 66 extends at right angles to the cutting directions of guillotine cutting device 54 and rotary cutting device 55.